Ref. 1

Japanese Laid-open Publication No. 11-88224

(Translation)

(11) Japanese Laid-open Publication No. 11-88224

(43) Publication Date: March 30, 1999

(21) Patent Application No. 9-257695

(22) Filing Date: September 4, 1997

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(54) [TITLE OF THE INVENTION] Transmitting-Receiving Apparatus, Repeating Apparatus and Wireless Communication System

(57) [ABSTRACT]

[Objective] A main objective is to provide a transmitting-receiving apparatus capable of preferentially carrying out emergency communication even when other transmitting-receiving apparatuses are transmitting.

[Means for Achieving Objective] In a transmitting-receiving apparatus 4 which is formed so that transmission and reception are possible through semi-duplex operation, an alarm control or a transmission stopping control for stopping transmission is carried out when a predetermined signal is included in received signals.

Japanese Laid-open Publication No. 11-88224

[CLAIMS]

[Claim 1] A transmitting-receiving apparatus formed so that transmission and reception are possible through semi-duplex operation, wherein

an alarm control or a transmission stopping control for stopping transmission is carried out when a predetermined signal is included in received signals.

[Claim 2] A transmitting-receiving apparatus formed so that transmission and reception are possible through semi-duplex operation, wherein

when a predetermined speech sound message signal or alarm sound signal is received, the received signal is emitted from a speaker.

[Claim 3] The transmitting-receiving apparatus according to Claim 1, comprising a storage portion where predetermined speech sound message data or alarm sound data is stored in advance, wherein when a predetermined signal is included in said received signals, an alarm sound is emitted from said speaker through said alarm control based on said stored speech sound message data or alarm sound data.

[Claim 4] The transmitting-receiving apparatus according to Claim 2 or 3, wherein the volume of said emitted sound is controlled to be greater than the volume of received sound in a normal state.

[Claim 5] A repeating apparatus, repeating a transmission signal between a plurality of transmitting-receiving apparatuses which are formed so that transmission and reception are possible through a semi-duplex operation and transmitting a transmission signal having such a content as to correspond to the type of communication signal communicated from an external apparatus via a communication line to said plurality of transmitting-receiving apparatuses.

[Claim 6] The repeating apparatus according to Claim 5, wherein said transmission signal having such a content as to correspond to the type of communication signal is a speech sound message signal or an alarm sound signal.

[Claim 7] The repeating apparatus according to Claim 5 or 6, wherein when a predetermined signal is communicated from said external apparatus, an alarm control signal or a transmission stopping control signal for stopping transmission is transmitted to said plurality of transmitting-receiving apparatuses.

[Claim 8] A wireless communication system, comprising a plurality of transmitting-receiving apparatuses each identical with the apparatus of any one of Claims 1 to 4 and the repeating apparatus of any one of Claims 5 to 7.

[Claim 9] A wireless communication system, comprising a plurality of wireless communication systems each identical with

the system of Claim 8, wherein said repeating apparatus in any one of said wireless communication systems transmits said alarm control signal or transmission stopping control signal for stopping transmission to the respective transmitting-receiving apparatuses in said plurality of wireless communication systems.

[Claim 10] The wireless communication system according to Claim 8 or 9, wherein said repeating apparatus adds identification data for identifying the repeating apparatus or said external apparatus when transmitting.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Field of the Invention]

The present invention relates to a transmitting-receiving apparatus for mutual communication through a semi-duplex operation using a predetermined pair of transmitting and receiving frequencies, a repeating apparatus for repeating transmission signals between a plurality of transmitting-receiving apparatuses, and a wireless communication system including these transmitting-receiving apparatuses and the repeating apparatus.

[0002]

[Prior Art]

Japanese Laid-open Publication No. 11-88224

Conventional specified low power wireless communication systems have been known as wireless communication systems including a plurality of transmitting-receiving apparatuses which make mutual communication possible through a semi-duplex operation of this type. Such a wireless communication system is formed of a plurality of transmitting-receiving apparatuses A to N at worksites and a repeater for repeating transmission signals between the transmitting-receiving apparatuses A to N so that mutual communication is possible, and a transmission frequency fa and a reception frequency fb are allocated in the respective transmitting-receiving apparatuses A to N in advance, and a transmission frequency fb and a reception frequency fa are allocated in the repeater in advance. In this configuration, in a case where a transmitting-receiving apparatus B transmits a signal to a transmitting-receiving apparatus C, for example, when the transmitting-receiving apparatus B transmits a signal with the transmission frequency fa, the repeater receives and demodulates the transmission frequency fa and transmits a signal with the transmission frequency fb, which is modulated using the demodulated signal. Meanwhile, the transmitting-receiving apparatus C receives the transmission signal of fb, and thus, receives the signal transmitted from the transmitting-receiving apparatus B. In contrast, in a case where the transmitting-receiving apparatus C responds to the

transmitting-receiving apparatus B, the transmitting-receiving apparatus C transmits a signal with the transmission frequency fa, and thus, can transmit a response signal to the transmitting-receiving apparatus B via the repeater. In this case, the other transmitting-receiving apparatuses A and D to N always receive the reception frequency fb using a so-called carrier sense function, and the transmission is prohibited when the reception level is at a predetermined level or higher so that interference can be prevented.

[0003]

[Problem to be Solved by the Invention]

However, these conventional wireless communication systems have the following problems. That is, these wireless communication systems have such problems that in a case where a pair of transmitting-receiving apparatuses B and C are continuously communicating with each other, when the operator of the transmitting-receiving apparatus A, for example, attempts to carry out emergency communication with the other transmitting-receiving apparatuses B to N, the emergency communication cannot be carried out unless the communication between the two transmitting-receiving apparatuses B and C is completed due to the carrier sense function. In such a case, the emergency communication cannot be carried out, and as a

result, an accident may be caused which could result in injury or death. In addition, in a case where a manufacturing apparatus for mass production is damaged in a factory and an attempt is made to notify other people involved in the manufacturing process, emergency communication cannot be carried out, and thus, production may be significantly affected. Accordingly, the conventional wireless communication systems have such a problem that the communication system has a significant defect.

[0004]

In general, transmitting-receiving apparatuses for communicating through this semi-duplex operation always receive the reception frequency fb but the received sound is not emitted from a speaker. Accordingly, it is possible to receive emergency communication by removing the carrier sense function and adopting such a configuration that the received sound is always emitted from a speaker. In this case, however, interference may occur as a beat phenomenon within the receiving portions of the transmitting-receiving apparatuses C (or B) to N because the transmission frequency for the transmitting-receiving apparatus A and the transmission frequency for another transmitting-receiving apparatus B (or C) which is transmitting are the same. Therefore, emergency communication cannot be carried out in practice.

[0005]

The present invention has been made in order to solve the above problems, and a main objective is to provide a transmitting-receiving apparatus capable of preferentially carrying out emergency communication even when other transmitting-receiving apparatuses are transmitting, and another objective is to provide a repeating apparatus which is appropriate for repeating transmission signals between these transmitting-receiving apparatuses and to provide a wireless communication system including these transmitting-receiving apparatuses and the repeating apparatus.

[0006]

[Means for Solving Problem]

In order to achieve the above objectives, the transmitting-receiving apparatus according to Claim 1 is a transmitting-receiving apparatus formed so that transmission and reception are possible through semi-duplex operation and is characterized in that an alarm control or a transmission stopping control for stopping transmission is carried out when a predetermined signal is included in received signals.

[0007]

In this transmitting-receiving apparatus that is in a normal state, the received sound is not emitted from the speaker through a semi-duplex operation when transmitting. Meanwhile,

in the case where a predetermined signal is included in the received signals, an alarm control is carried out for alerting the operator of the transmitting-receiving apparatus that has received the signal to the effect that the transmission should be stopped or prohibited at the time of both transmission and reception. In this case, an alarm signal can be displayed on the display apparatus or an alarm sound can be emitted from a speaker. In addition, a transmission stopping control for automatically stopping transmission may be carried out during transmission. As a result, it becomes possible for the operator who has transmitted a predetermined signal to preferentially carry out emergency communication and the like without fail and without causing interference in other transmitting-receiving apparatuses.

[0008]

The transmitting-receiving apparatus according to Claim 2 is a transmitting-receiving apparatus formed so that transmission and reception are possible through semi-duplex operation and is characterized in that when a predetermined speech sound message signal or alarm sound signal is received, the received signal is emitted from a speaker.

[0009]

In this transmitting-receiving apparatus, when a predetermined speech sound message signal or an alarm sound

signal is transmitted from another transmitting-receiving apparatus, the received sound is emitted from a speaker. Accordingly, the operator of the transmitting-receiving apparatus that has emitted sound can immediately understand that emergency communication is being carried out or that the state has become abnormal even during transmission. As a result, transmission by the other transmitting-receiving apparatuses is stopped, and consequently, it becomes possible for the operator who has transmitted a predetermined speech sound message signal or an alarm sound signal to preferentially carry out emergency communication and the like.

[0010]

The transmitting-receiving apparatus according to Claim 3 is the transmitting-receiving apparatus according to Claim 1 and is characterized by comprising a storage portion where predetermined speech sound message data or alarm sound data is stored in advance so that when a predetermined signal is included in received signals, an alarm sound is emitted from the speaker through the alarm control based on the stored speech sound message data or alarm sound data.

[0011]

A predetermined speech sound message signal or an alarm sound signal is transmitted from the transmitter side, and thus, a speech sound message or alarm sound can be emitted to the other

transmitting-receiving apparatuses. Meanwhile, in this transmitting-receiving apparatus, a predetermined signal that has been preset as an emergency signal is transmitted, and thus, an alarm sound is emitted based on speech sound message data and alarm sound data which are stored in the other transmitting-receiving apparatuses side. In this case, it becomes possible to emit a clear speech sound message and the like without the speech sound message or alarm sound becoming unclear due to interference.

[0012]

The transmitting-receiving apparatus according to Claim 4 is the transmitting-receiving apparatus according to Claim 2 or 3 and is characterized in that the volume of the emitted sound is controlled to be greater than the volume of received sound in a normal state.

[0013]

Even when a speech sound message is emitted in an abnormal state, the alarm for stopping transmission has fewer effects as in a case where the volume of the received sound is low. In this transmitting-receiving apparatus, the speech sound message is emitted with a volume greater than in a normal state, and therefore, it becomes possible for the operator to understand that emergency communication is being carried out without fail.

[0014]

A repeating apparatus according to Claim 5 is characterized by repeating a transmission signal between a plurality of transmitting-receiving apparatuses which are formed so that transmission and reception are possible through a semi-duplex operation and transmitting a transmission signal having such a content as to correspond to the type of communication signal communicated from an external apparatus via a communication line to the plurality of transmitting-receiving apparatuses. In this case, the external apparatus can communicate a communication signal via either a wire communication line or a wireless communication line.

[0015]

In the case where a communication signal, such as for an abnormality in the apparatus, is communicated from an external apparatus, such as a unit for mass production, for example, the relay apparatus transmits a transmission signal having a content in accordance with that type of communication signal to a plurality of transmitting-receiving apparatuses. In this case, when transmitting-receiving apparatuses are transmitting and receiving to and from each other, the pair of transmitting-receiving apparatuses carries out an alarm control and a transmission stopping control. Therefore,

during transmission, the operator can be notified that the state has become abnormal or an emergency has occurred, and it becomes possible to receive a transmission signal from the repeating apparatus without causing interference by immediately stopping the transmission.

[0016]

In this case, a speech sound message signal or an alarm sound signal may be transmitted as a transmission signal having a content in accordance with the type of communication signal instead of an alarm control signal or a transmission stopping control signal for stopping transmission.

[0017]

A wireless communication system according to Claim 8 is characterized by having a plurality of transmitting-receiving apparatuses each identical with the apparatus of any one of Claims 1 to 4 and the repeating apparatus of any one of Claims 5 to 7.

[0018]

In this wireless communication system, in the case where a pair of transmitting-receiving apparatuses are transmitting and receiving between each other, the repeating apparatus transmits a speech sound message signal, an alarm sound signal, an alarm stopping control signal or a transmission stopping control signal so that transmission and reception between the

transmitting-receiving apparatuses can be stopped, and it becomes possible to transmit abnormalities in the external apparatus to all the transmitting-receiving apparatuses.

[0019]

A wireless communication system according to Claim 9 is formed of a plurality of wireless communication systems each identical with the system of Claim 8 and is characterized in that a repeating apparatus in any one of the wireless communication systems transmits an alarm control signal or a transmission stopping control signal for stopping transmission to the respective transmitting-receiving apparatuses in the plurality of wireless communication systems.

[0020]

In this wireless communication system, in the case where an abnormality is caused in a specific external apparatus, it becomes possible to make all the transmitting-receiving apparatuses communicate collectively in a plurality of wireless communication systems.

[0021]

The wireless communication system according to Claim 10 is the wireless communication system according to Claim 8 or 9 and is characterized in that the repeating apparatus adds identification data for identifying the repeating apparatus or the external apparatus when transmitting.

[0022]

In this wireless communication system, identification data for identifying the repeating apparatus or the external apparatus is added when an alarm control signal or a transmission stopping control signal is transmitted from the repeating apparatus, and therefore, it becomes possible for the operator of the transmitting-receiving apparatus to immediately specify the external apparatus where an abnormality has occurred, for example.

[0023]

[Embodiments of the Invention]

Hereinafter, a transmitting-receiving apparatus, a repeating apparatus and a wireless communication system according to preferred embodiments of the present invention will be described with reference to the accompanying drawings.

[0024]

First, the configuration of the wireless communication system as a whole will be described with reference to Fig. 1. As shown in the figure, a wireless communication system 1 is formed of a combination of a plurality of communication systems **2a** to **2n** (hereinafter also collectively referred to as "communication system **2**"). The communication systems 2a to 2n are different only in the frequency allocated for transmission and reception, and the rest of the configuration and the

functions are the same, and thus, a typical example of the configuration and functions of the communication system **2a** will be described below.

[0025]

The wireless communication system **2** targets communication between a plurality of workers who maintain or inspect apparatuses **3**, such as printing machines, and is provided with a plurality of receivers **4a** to **4n** (hereinafter also collectively referred to as "receiver **4**"), which correspond to transmitting-receiving apparatuses according to the present invention, and repeating apparatuses **6** which repeat communication between receivers **4** and **4**, and are connected to the apparatuses **3** via wired communication lines **5**. In addition, the repeating apparatuses **6** are provided with a repeater **A 11** which corresponds to the repeating apparatus according to the present invention, an interface portion **12**, and a repeater **B 13**. Here, the interface portion **12** is provided to receive and transmit various types of signals, and all or certain signals from among the signals communicated from the apparatus **3** or the repeater **B 13** are communicated to the interface portion **12** in another communication system **2** via the communication line **14**. As a result, the below described collective communication becomes possible.

[0026]

The receivers **4** are formed so that transmission and reception in a frequency modulating system are possible through a semi-duplex operation with a preset pair of frequencies for transmission and reception. Concretely, the receivers **4** are formed so as to use f_{1a} in a band from 420 MHz to 430 MHz (f_{1b} to f_{1n} in the respective communication systems **2b** to **2n**) and f_{2a} (f_{2b} to f_{2n} in the respective communication systems **2b** to **2n**) as the frequency for transmission and the frequency for reception, respectively, and furthermore, use a frequency for transmission f_{3a} (f_{3b} to f_{3n} in the respective communication systems **2b** to **2n**) which is different from f_{1a} as the frequency for transmission in emergency communication. Concretely, in the configuration, the receivers **4** are provided with an antenna **21**, a microphone **22**, a transmitting portion **23**, a channel oscillating portion **24**, an operation switch for emergency communication **25**, an antenna duplexer **26**, a receiving portion **27**, a switching portion **28**, a low frequency amplifying portion **29**, a speaker **30**, an MSK data demodulating portion **31**, a CPU **32**, a ROM **33** and a display portion **34**, as shown in Fig. **2**.

[0027]

Here, the transmitting portion **23** operates when the press-to-talk switch (hereinafter referred to as a "PTT switch"), not shown, is operated, generates a transmission signal by modulating the carrier wave using the speech sound

signal outputted from the microphone **22**, and transmits the transmission signal from the antenna **21** via the antenna duplexer **26**. In addition, the transmitting portion **23** transmits the MSK modulated transmission signal based on the group number data outputted from the CPU **32** when transmission starts, and after that, transmits the modulated transmission signal using a speech sound signal. The operation switch **25** is operated at the time of emergency communication or the like, and when operated the PTT switch is linked and operated, so that the transmitting portion **23** is forced to operate and the channel oscillation frequency in the channel oscillating portion **24** formed of a PLL (Phase Locked Loop) is changed to a predetermined frequency, and thus, the transmitting portion **23** forcibly changes the frequency for transmission to f_{3a}. As described below, forcible transmission is carried out under such conditions that the frequency for transmission f_{3a} is not used. The receiving portion **27** demodulates the received signal inputted via the antenna **21** and the antenna duplexer **26** to a low frequency signal and outputs it to the switching portion **28** and the MSK data demodulating portion **31**. The switching portion **28** outputs the received sound signal demodulated by the receiving portion **27** to the low frequency amplifying portion **29** when a connection signal S_{ON} is outputted from the CPU **32**. The MSK data demodulating portion **31** converts the MSK signal

included in the received sound signal to digital data and outputs the converted MSK signal to the CPU **32**. In the low frequency amplifying portion **29**, the gain can be freely set using the volume for adjusting the volume, not shown, and when a volume control signal S_{VOL} is outputted from the CPU **32**, a predetermined volume is automatically set, irrespectively of the set volume.

[0028]

The CPU **32** carries out a reception control process, an alarm control process and the like. In the reception control process, the CPU **32** determines whether or not the digital data outputted from the MSK data demodulating portion **31** includes group number data corresponding to the group number of its own station, and when it is determined that it is included, controls the switching portion **28** so that it becomes of a connected state by outputting a connection signal S_{ON}. Meanwhile, the alarm control process is a process carried out to stop transmission when there is emergency communication and alarm sound is emitted from the speaker **30**. Concretely, the CPU **32** first determines whether the digital data outputted from the MSK data demodulating portion **31** includes predetermined emergency signal data. When it is determined that it is included, the CPU **32** determines that it is emergency communication and reads out alarm sound data stored in the ROM **33**, so that digital-analog

conversion is carried out on the read-out alarm sound data in the incorporated D/A converting portion. Next, the converted alarm sound signal S_A is outputted to the input portion of the low frequency amplifying portion **29** and a volume control signal S_{VOL} is outputted to the low frequency amplifying portion **29**, so that the volume is controlled so as to be greater than in a normal state. As a result, the speaker **30** emits alarm sound. In addition, the CPU **32** outputs a connection signal S_{ON} to the switching portion **28**, and thus the received sound signal is outputted to the low frequency amplifying portion **29**. As a result, the received sound is emitted from the speaker **30** even during transmission.

[0029]

Though in this example, it is warns that the transmission must be manually stopped when there is emergency communication, the CPU **32** may output a transmission stopping signal S_S to the transmitting portion **23** at the point in time when the emergency signal data is detected, and thus, transmission stopping control for immediately and automatically stopping transmission by the transmitting portion **23** may be carried out. In addition, speech sound message data may be stored in the ROM **33** in advance instead of alarm sound data, and this speech sound message data may be converted to an analog signal in the D/A converting portion and outputted to the low frequency

amplifying portion **29**. Furthermore, emergency signal data, an alarm sound signal and a speech sound message signal are included in the transmission signal and transmitted, and when the CPU **32** determines that emergency signal data is included, the connection signal S_{ON} may be outputted, so that alarm sound is emitted from the speaker **30** based on the received alarm sound signal or speech sound message signal.

[0030]

Next, the configuration of the repeater **A 11** will be described with reference to Fig. **3**.

[0031]

As shown in Fig. **3**, the repeater **A 11** is provided with an antenna **41**, an antenna duplexer **42**, a transmitting portion **43**, a receiving portion **44**, a CPU **45** and a ROM **46**. In the repeater **A 11**, the frequency for transmission and the frequency for reception are allocated to f_{2a} (f_{2b} to f_{2n} in the respective communication systems **2b** to 2n) and f_{1a} (f_{1b} to f_{1n} in the respective communication systems **2b** to **2n**), respectively, in advance, so that the transmission signal with the frequency for transmission f_{1a} transmitted from a receiver **4** is received and demodulated, and at the same time, the carrier wave is demodulated using the demodulated signal as the modulated signal, and thus, the signal is transmitted using the frequency for transmission f_{2a}. As a result, the repeater **A 11** transmits

the transmission signal transmitted from one receiver **4** to the other receivers **4**.

[0032]

Next, the configuration of the repeater **B 13** will be described with reference to Fig. **4**.

[0033]

As shown in Fig. **4**, the repeater **B 13** is provided with an antenna **51**, a receiving portion **52**, a CPU **53** and a RAM **54**. Here, the CPU **53** and the RAM **54** form a sound recorder, and the CPU **53** carries out analog-digital conversion on the received sound signal received by the receiving portion **52** and stores the converted digital data in the RAM **54**. In addition, in the repeater **B 13**, when a transmission signal of f_{3a} (f_{3b} to f_{3n} in the respective communication systems **2b** to **2n**) for emergency communication is transmitted from a receiver **4**, the received signal is stored in the RAM **54**, and after that communicated to the repeater **A 11** via the interface portion **12**.

[0034]

Next, the operation in the wireless communication system **1** as a whole will be described.

[0035]

First, operation in a normal state will be described. In a normal state, when the receiver **4a** transmits a signal with the frequency for transmission f_{1a}, the repeater **A 11** receives

and demodulates this transmission signal and transmits the demodulated signal with the frequency for transmission f_{2a}. As a result, the other receivers **4b** to **4n** can receive the signal transmitted from the receiver **4a**. In this case, the receiver **4a** transmits and receives the signal through a semi-duplex operation, and therefore, the speaker **30** does not emit the received sound. Meanwhile, when the CPUs **32** in the receivers **4b** to **4n** determine that the group number data for their own stations is included, they output a connection signal S_{ON} so that the received sound is emitted from the speaker **30**. Next, when a receiver **4b**, for example, which is called by the receiver **4a** responds with the frequency for transmission f_{1a}, the repeater **A 11** receives and demodulates the transmission signal, so that the demodulated signal is transmitted with the frequency for transmission f_{2a}. As a result, mutual communication between the two receivers **4a** and **4b** is carried out.

[0036]

Next, operation in the case where communication is held between two receivers **4** and **4** while the other receivers **4** carry out emergency communication will be described.

[0037]

In the case where the receivers **4a** and **4b** communicate with each other, for example, when the operation switch **25** is operated on the receiver **4n** side, the CPU **32** of the receiver

4n determines whether or not emergency communication with the frequency for transmission f_{3a} is being carried out at that time. In this case, the CPU 32 can determine whether or not there is emergency communication with the frequency for transmission f_{3a} based on whether or not the below described emergency signal data has been transmitted. Here, the CPU 32 allows the receiving portion 27 to carry out so-called scanning reception and determine that emergency communication with the frequency for transmission f_{3a} is not being carried out when the reception level of the received signal for the frequency for transmission f_{3a} is a predetermined value or less. When it is determined that emergency communication with the frequency for transmission f_{3a} is not being carried out, the CPU 32 starts allowing the transmitting portion 23 to transmit the signal with the frequency for transmission f_{3n}. Next, when the operator talks into the microphone 22, a speech sound signal is transmitted with the frequency for transmission f_{3n}. Meanwhile, the receiving portion 52 in the repeater B 13 receives the frequency for transmission f_{3n}, and when the reception level exceeds a predetermined value, the carrier detection signal S_K is outputted to the CPU 53. As a result, the CPU 53 determines that emergency communication has been carried out, and subsequently carries out analog-digital conversion on the speech sound signal outputted from the receiving portion 52 in

the incorporated A/D converting portion, and after that stores the signal in the RAM **54**. Next, the CPU **53** reads out the speech sound signal stored in the RAM **54** and adds emergency signal data showing emergency communication and identification data D_S for identifying the communication system to which its own station belongs, and after that, communicates with the repeater **A 11** via the interface portion **12**. In this case, the interface portion **12** communicates with the interface portions **12** in the other communication systems **2** via the communication lines **14**. Next, the CPU **45** in the repeater **A 11** in each communication system **2** determines that emergency communication has been carried out using emergency signal data, and outputs the emergency signal data and the speech sound signal to the transmitting portion **43**. The transmitting portion **43** transmits a transmission signal that is MSK modulated based on the emergency signal data, and transmits a transmission signal that is frequency modulated based on the speech sound signal.

[0038]

As a result, in each receiver **4a** to **4(n - 1)** in each communication system **2**, the CPU **32** detects the MSK demodulated emergency signal data, and thus determines that emergency communication is being carried out and outputs a volume control signal S_{VOL} to the low frequency amplifying portion **29**, so that the volume is controlled so as to be loud, and at the same time,

reads out the alarm sound data corresponding to the emergency signal data from the ROM **33**, so that sound is emitted from the speaker **30**. Next, the CPU **32** outputs a connection signal S_{ON} so that the switching portion **28** is controlled so as to become of a connected state, and thus allows the sound received from the receiving portion **27** to be emitted from the speaker **30**. In addition, in parallel with these processes, the CPU **32** displays the group plurality in the transmitted communication system **2** on the display portion **34** based on the received identification data D_S. As a result, the operator of each receiver **4** can receive the group plurality of the transmitted communication system **2** and the content of the emergency communication carried out by the receiver **4n**. In this case, the operator of the receiver **4** during transmission can be immediately notified by the emitted alarm sound that emergency communication is being carried out, and thus can stop transmission and receive emergency communication. Here, during transmission, when the receiver **4** stops transmission the operator who carries out emergency communication can transmit subsequent signals with the frequency for transmission f_{1a}, and the operator of each receiver **4** can receive the signal with f_{1a} transmitted via the repeater **A 11** as it is. Thus, the wireless communication system **1** can preferentially carry out emergency communication without fail.

[0039]

Next, a description will be given for a case of emergency communication where a problem arises with an apparatus 3, such that the ink runs out, the paper runs out or the shaft of the rotary press is broken. The apparatus 3 outputs problem signals S_1 to S_m corresponding to the detail of the problem and the identification data D_S for its own station to the repeater A 11 via the wired communication line 5 and the interface portion 12. In this case, the interface portion 12 communicates the communication signal with the same content to the interface portion 12 in the other communication systems 2 via the communication lines 14. Next, the CPU 45 in the repeater A 11 in each communication system 2 identifies the inputted problem signals S_1 to S_m, and at the same time reads out the alarm data D_A from the ROM 46 in accordance with the type of problem signals S_1 to S_m identified. Next, the CPU 45 outputs the read-out alarm data D_A and the transmitted identification data D_s to the transmitting portion 43. The transmitting portion 43 MSK modulates the signal based on the alarm data D_A and the identification data D_S outputted from the CPU 45, and after that transmits the signal with the frequency for transmission f_{2a}.

[0040]

In this case, each receiver 4 in each communication system 2 receives the transmission signal from the repeater A 11, and

the CPU **32** in the receiver **4** determines whether or not the demodulated signal demodulated by the MSK data demodulating portion **31** includes predetermined alarm data D_A. In the case where it is determined that it is included, the CPU **32** outputs a volume control signal S_{VOL} to the low frequency amplifying portion **29**, so that the volume is controlled so as to be loud, and at the same time, reads out the alarm sound data corresponding to the alarm data D_A from the ROM **33** so that sound is emitted from the speaker **30**, and displays the detail of the problem corresponding to the alarm data D_A and the apparatus number of the apparatus **3** in the communication system **2** corresponding to the identification data D_S on the display portion **34**. Next, the CPU **32** outputs a connection signal S_{ON} so as to control the switching portion **28** in a connected state, and thus, the received sound from the receiving portion **27** is emitted from the speaker **30**. As a result, the operator of each receiver **4** in all of the communication systems **2** can be notified that a problem has arisen with the apparatus **3** in a certain communication system **2**, and at the same time, the detail of the problem can be immediately relayed by means of the type of alarm sound, and as a result, a quick response becomes possible. Here, alarm sound is emitted to the receiver **4** during transmission, and therefore, the operator of the receiver **4** can stop transmission, so that emergency communication relating to the

apparatus **3** can be subsequently transmitted and received between respective receivers **4** and **4** using the frequency for transmission f_{1a}.

[0041]

Meanwhile, in the case where communication is held between the receivers **4a** and **4b** as in the above-described example, when the CPU **32** in each receiver **4a** or **4b** determines that the signal demodulated by the MSK data demodulating portion **31** includes predetermined alarm data D_A, an alarm control process is carried out. As a result, the operator stops transmission.

[0042]

Here, the present invention is not limited to the above-described embodiments, and the configuration thereof can be modified as deemed appropriate. Though in the present embodiment, an example of application to maintenance and inspection of printing machines has been described, the invention is not limited thereto, and can be applied to communication systems for maintenance and guiding of airplanes, as well as to all other communication systems which require emergency communication, for example. In addition, though an example where emergency communication is collectively carried out in all of the communication systems **2** has been described in this embodiment, it is, of course, possible to carry out

emergency communication separately in each communication system **2**.

[0043]

[Effects of the Invention]

As described above, in the transmitting-receiving apparatus according to Claims 1 to 4, when a predetermined signal is included in received signals, the transmitting-receiving apparatus carries out an alarm control or a transmission stopping control for stopping transmission, and thus, the operator who has transmitted a predetermined signal can preferentially carry out emergency communication without fail and without causing interference in the other transmitting-receiving apparatuses. In addition, a speech sound message or an alarm sound is emitted from a speaker at the time of emergency communication so that the operator of the other transmitting-receiving apparatus can be notified of this without fail. Furthermore, the received sound at this time is controlled to have a volume greater than that of the received sound at a normal time, and thus, the operator can understand without fail that emergency communication has been carried out.

[0044]

In addition, the repeating apparatus according to Claims 5 to 7 can transmit a communication signal, such as for an abnormality in the apparatus that has occurred in an external

apparatus such as a unit for mass production, to the respective transmitting-receiving apparatuses without causing interference.

[0045]

Furthermore, in the wireless communication system according to Claims 8 to 10, in the case where a pair of transmitting-receiving apparatuses are transmitting and receiving between each other, a speech sound message, an alarm sound, an alarm control signal or a transmission stopping control signal is transmitted from the repeating apparatus so that transmission and reception between the transmitting-receiving apparatuses can be stopped, and abnormalities in an external apparatus can be transmitted to all the transmitting-receiving apparatuses. In addition, in the case where the configuration is provided with a plurality of wireless communication systems, the repeating apparatus transmits an alarm control signal or a transmission stopping control signal to the respective transmitting-receiving apparatuses in a plurality of wireless communication systems, and thus, it becomes possible to make all the transmitting-receiving apparatuses communicate collectively in the plurality of wireless communication systems. In this case, the operator of each transmitting-receiving apparatus can immediately specify the external apparatus where an abnormality

is caused by adding identification data.

[Brief Description of the Drawings]

Fig. 1 is a diagram showing the configuration of a wireless communication system according to an embodiment of the present invention.

Fig. 2 is a block diagram showing a receiver according to the embodiment of the present invention.

Fig. 3 is a block diagram showing a repeater A according to the embodiment of the present invention.

Fig. 4 is a block diagram showing a repeater B according to the embodiment of the present invention.

[Explanation of Symbols]

1 Wireless communication system

2 Communication system

3 Apparatus

4a to 4n Receiver

6 Repeating apparatus

11 Repeater A

13 Repeater B

[Fig. 2]

21 Antenna

22 Microphone

23 Transmitting portion

24 Channel oscillating portion

26 Antenna duplexer

27 Receiving portion

28 Switching portion

29 Low frequency amplifying portion

30 Speaker

31 MSK data demodulating portion

34 Displaying portion

[Fig. 3]

A To interface portion

42 Antenna duplexer

43 Transmitting portion

44 Receiving portion

[Fig. 1]

3 Apparatus

11 Repeater A

12 Interface portion

13 Repeater B

[Fig. 4]

A To interface portion

52 Receiving portion

復調信号内に所定のアラームデータD，が含まれていると判別したときには、警報制御処理を実行する。これにより、操作者によって送信が停止される。

【００４２】なお、本発明は、上記した実施の形態に限定されず、その構成を適宜変更することができる。例えば、本実施形態では、印刷機械の保守点検に用いる例について説明したが、これに限定されず、例えば、飛行機の整備や誘導を行うための通信システムなどにも用いることができるし、緊急連絡通信を必要とするすべての通信システムに適用が可能である。また、この実施の形態では、緊急連絡通信をすべての通信システム２に一斉連絡する例について説明したが、各通信システム２単位で緊急連絡通信することも勿論可能である。

【００４３】

【発明の効果】以上のように、請求項１記載から４記載の送受信装置によれば、送受信装置が、受信した受信信号内に所定の信号が含まれているときに、送信を停止させるための警報制御または送信停止制御を行うことにより、所定の信号を送信した操作者は、他の送受信装置において混信を起こさせることなく、緊急連絡通信などを確実かつ優先的に行うことができる。また、緊急連絡通信時に音声メッセージやアラーム音をスピーカから放音することにより、他の送受信装置の操作者に対してその旨を確実に通信することができる。さらに、その際の受信音を通常時における受信音量よりも大音量に制御することにより、操作者は、緊急連絡通信などが行われたことを、より確実に理解することができる

【００４４】また、請求項５から７記載の中継装置によれば、量産機器などの外部装置において生じた機器異常などの通信信号を、混信を生じさせることなく各送受信装置に対して送信することができる。＊

＊【００４５】さらに、請求項８から１０記載の無線通信システムによれば、１対の送受信装置同士が送受信している場合において、中継装置から音声メッセージ、アラーム音、警報制御信号または送信停止制御信号を送信することにより、送受信装置同士の送受信を停止させることができ、外部装置の異常などをすべての送受信装置に対して送信することができる。また、複数の無線通信システムを備えて構成した場合、中継装置が、警報制御信号や送信停止制御信号を複数の無線通信システムにおける各送受信装置に対して送信することにより、複数の無線通信システムにおけるすべての送受信装置に対して一斉連絡を行うことができる。この場合、識別データを付与することにより、各送受信装置の操作者は、異状が生じた外部装置などを直ちに特定することができる。

【図面の簡単な説明】

【図１】本発明の実施の形態に係る無線通信システムの構成図である。

【図２】本発明の実施の形態に係る子機のブロック図である。

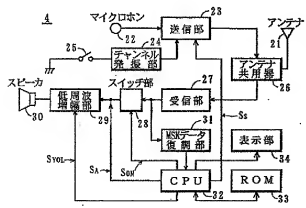
【図３】本発明の実施の形態に係るＡ中継機のブロック図である。

【図４】本発明の実施の形態に係るＢ中継機のブロック図である。

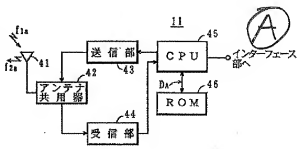
【符号の説明】

１　無線通信システム
２　通信システム
３　機器
４ａ～４ｎ　子機
６　中継装置
１１　Ａ中継機
１３　Ｂ中継機

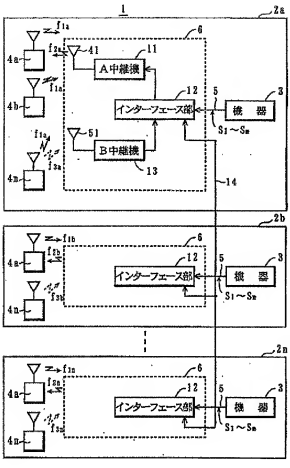
【図２】



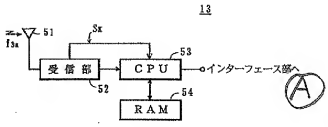
【図３】



【図１】


1
2a
2b
2n
4a
4b
4n
6
11
12
13
14
41
51
5
3
A中継機
B中継機
インターフェース部
機　器
S1～Sn
f1a
f2a
f1b
f2b
f1n
f2n
f3a
f3b
f3n

【図４】


13
51
5x
53
受信部
52
ＣＰＵ
54
ＲＡＭ
インターフェース部へ
A
f3a